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dual enrollment special report

for Nebraska Public Schools
& Postsecondary Institutions

TECHNICAL DOCUMENTATION

VERSION 1.1
APRIL 11, 2025



Data

Dual enrollment

Dual enrollment programs provide opportunities for high school students to earn college credit before high school graduation. Per the definition of dual enrollment in Nebraska (LB814, 2023), a student is dually enrolled if they have a postsecondary transcript showing they took at least one for-credit course in a term that started before they graduated high school. NSWERS' dual enrollment calculations do not include coursework taken at private and tribal postsecondary institutions or Advanced Placement (AP) college credit as these data are not currently included in the NSWERS Data System.

Determination of dual enrollment participation requires connecting high school records with Nebraska public postsecondary records. Specifically, for every Nebraskan public high school student, NSWERS identified transcript records associated with course terms that began prior to a student's high school graduation date. Per LB814 only transcript records that were recorded as graded and for-credit were used to determine dual enrollment participation.

Participants versus Earners

Earned course credit: means a student was determined to have earned dual enrollment course credit if they received more than zero grade points in the course. This does not necessarily imply that the student transferred this course credit to fulfill any subsequent college degree/certificate requirements.

Population

This NSWERS special report includes data on Nebraskan public high school students who were expected to complete high school between the 2016 and 2022 school year endings.

Cohorts

High school cohort The high school cohorts are grouped based on their expected high school graduation year which is defined as four years after a high school student's initial ninth grade start year. In cases where a student may have more than one recorded expected high school graduation date, the maximum value was chosen.

Section 1. Dual enrollment data

High School Cohort, participants, and earners

The counts in this section are unduplicated counts. This means that every individual can only contribute once across all cohort years.

Postsecondary institutions

Where do students within each high school cohort participate in dual enrollment?

The counts in this section can include duplicates within a cohort year. This is because some students within a cohort year may have taken dual enrollment coursework through more than one postsecondary institution. This means that the denominator used to calculate percentages is not technically the cohort size. Rather it is the total number of unique student enrollments in every public postsecondary institution within a cohort year. For example, if a student took dual enrollment courses at two different colleges within a single year, this one student would be counted twice, once at each college at which they were dually enrolled.

How does dual enrollment participation differ geographically?

This section presents rates of dual enrollment participation by community college service area (CCSA). The CCSA for a student is identified by mapping the district and school included in NSWERS K-12 student enrollment records to the counties included within each CCSA. Since students may attend different districts or schools within a single year which can complicate assignment of CCSA, only one district and school pairing per student per school year was selected. This was accomplished using the following sequential filtering procedure:

1. Choose district-school pairs associated with the latest enrollment for each student within a school year.
2. Choose district-school pairs associated with enrollment event codes related to transferring into a school, not enrollment codes related to exiting a school.
3. Choose district-school pairing associated with the school records associated with the max enrollment code number.
4. Choose district-school pairing associated with the max district code number.
5. Choose district-school pairing associated with the max school code number.

This procedure successfully assigned a single unique school to each student in every school year. Note that the final three filter conditions are arbitrary. However, these filter steps applied to relatively few students.

From which districts/schools do Nebraska students access dual enrollment?

The district and school data for this section was derived using the logic described in the previous section. The top five districts by dual enrollment count were selected by selecting the districts that had the highest median dual enrollment counts between 2014 and 2022 school year ending.

In which grades do Nebraska students take dual enrollment courses?

Grade-level information was directly obtained from K-12 student data records. The student counts may be duplicated over time since dual enrollment participation is counted for each grade. For example, if a student took dual enrollment coursework as a junior and senior in 2019 and 2020, this student would be counted twice; once in each year and grade level.

How many dual enrollment credits do Nebraska students earn?

The number of dual enrollment credits earned by each student was obtained by linking dual enrollment postsecondary transcript records and adding all credits associated with classes that were passed. Credit hours earned at institutions on a quarter system were converted to semester hours by dividing by 1.5. This adjustment was performed for all courses taken at Metropolitan Community College and for courses taken in terms prior to academic year ending 2020 at Southeast Community College.

What dual enrollment courses and subjects do Nebraska students take?

Dual enrollment courses were obtained from linked postsecondary transcript records. The course subject names were used to group common course enrollment subject areas. Course subject codes are not standardized across institutions (ex. biology courses may be coded as “BIOL”, “BIO”, “BIOS”, etc.) so these course subject codes were reviewed and combined to provide more accurate counts and rankings of courses subjects by dual enrollment counts.

The number of unique courses (subjects) was determined by finding the annual count of distinct course subject and course codes (course subjects). Note this may be an overestimate of the number of unique courses, since it is possible that a course may be represented using a different course code number between at different institutions even if the course is a transferable equivalent. Also, the manual process of harmonizing the course subject codes may have overlooked rarer courses.

How do Nebraska dual enrollment students perform academically?

High school GPA: The high school GPA was calculated across all years that a student attended Nebraska public high school. All course grades were converted to a 4.0 scale then averaged for each student.

Due to the varying grading codes used at different schools, all course grades were standardized to a 4.0 scale and then averaged for each student. Letter grades were converted as follows: ‘A’ equals four points, ‘B’ equals three points, ‘C’ equals two points, ‘D’ equals one point, and ‘F’ equals zero points, with no consideration for ‘+’ or ‘-’ signs. Numeric grades from 0-100 were converted such that 90-100 equals four points, 80-89 equals three points, 70-79 equals two points, 60-69 equals one point, and below 60 equals zero points. Courses without a grade, like pass/fail or audited courses, were excluded from the GPA calculation. Additionally, no extra points were given for Advanced Placement, International Baccalaureate, or other honors classes.

Note that there is no direct record of credit hours in NSWERS data system, so high school GPA calculations are not weighted by credit hours. In the future, NSWERS may explore strategies to weight the GPAs by term length.

Postsecondary GPA: The first-year postsecondary GPA was calculated for all first-time, full-time, degree-seeking students who attended a Nebraska public postsecondary. The overall first-year GPA was determined for each student by computing the sum of attempted credit per term weighted by term GPA and dividing it by the total number of attempted credits taken in the student’s first-year. If a student was first-time, full-time, degree-seeking at more than one Nebraska public postsecondary, the GPA obtained at the institution that is offers higher degree-levels (four-year over two-year) was chosen. If a student attended more than one four-year institution, the first-year GPA associated with the institution at which they attempted the most credits was selected.

Career and Technical Education

Career and Technical Education (CTE) courses were distinguished from General Studies courses at two-year colleges using the Reimbursable Education Unit (REU) weights associated with the course. If a course had an REU weight of at least 1.5, the course was designated as CTE.

Race/ethnicity

Student race/ethnicity was determined using a combination of K-12 and postsecondary data which allows up to five non-exclusive choices for student race and a binary indicator for Hispanic ethnicity. These data are used to derive a race/ethnicity code in line with IPEDS reporting categories for race (<https://nces.ed.gov/ipeds/report-your-data/race-ethnicity-definitions>). This results in seven race/ethnicity categories:

- Hispanic: any student who had affirmed Hispanic ethnicity, regardless of race selection.
- Two or more races (Multiracial): any student who is not Hispanic and selected two or more races.

Students can be categorized as the following only if they are non-Hispanic and were only designated in one racial category.

- American Indian or Alaska Native
- Asian
- Black or African American
- Native Hawaiian or Other Pacific Islander
- White

Gender

Student gender is determined by NSWERS using the most recently available record of a student's reported gender (female or male). This may come from postsecondary enrollment file records or from Nebraska public K-12 records.

Data missingness

There are low rates of missing data for high school derived fields. Demographic and risk factor data has no missingness. There are very low rates of missing gender data. There is more missing data for NSWERS derived variables like the proportion of days a student was absent during high school or average high school GPAs.

Cohort	Homeless	Hi. mobile	Immig.	EL part.	SPED part.	HAL elig.	HAL part.	Prop. days absent	Race	Gender	HS GPA	Cohort size
2016	0	0	0	0	0	0	0	284	0	<10	782	25,081
2017	0	0	0	0	0	0	0	310	0	<10	766	25,443
2018	0	0	0	0	0	0	0	303	0	<10	822	26,304
2019	0	0	0	0	0	0	0	316	0	<10	878	26,323
2020	0	0	0	0	0	0	0	310	0	<10	922	26,774
2021	0	0	0	0	0	0	0	282	0	<10	848	26,895
2022	0	0	0	0	0	0	0	301	0	<10	960	27,521

Abbreviations: Participants (Part.), Eligible (Elig.), Highly Mobile (Hi.Mobile), Imigrants (Immig.), English Language (EL), Special Education (SPED), and High Ability Learner (HAL).

Outcomes

This section describes how each outcome is derived from the NSWERS Data System and how cohorts are defined for each outcome.

On-time high school graduation

Cohort: All Nebraska public high school students who did not transfer out of the Nebraska public school system or were deceased prior to high school graduation.

Operationalization: A student graduated high school on-time if they graduated within four years of starting ninth grade. Only students who earned regular diplomas, not alternative diplomas or GEDs, are defined as graduates in this report.

The cohort used to calculate counts and rates of on-time high school graduation is a subset of the “high school cohort” used to track dual enrollment counts and rates. Per NDE guidelines on constructing the expected graduation year cohort, NSWERS excluded students from calculation of counts and rates of on-time high school graduation if they exited the Nebraska public school system or died prior to high school graduation. On-time high school graduation is determined using data from NDE’s enrollment records.

College going

Cohort: On-time Nebraska public high school graduates.

Operationalization: A student is considered college going if they enrolled in college within 16 months of the date they graduated high school. High school graduation is determined using NDE enrollment records. College going is determined using enrollment records from NSWERS’s Nebraska public postsecondary partners in addition to National Student Clearinghouse data.

Postsecondary persistence

Cohort: College-goers at any Nebraska public institution and any National Student Clearinghouse (NSC) covered postsecondary institution.

Operationalization: A student persisted if they are enrolled in any college during the fall term of the next calendar year after their initial postsecondary enrollment or if they earned a postsecondary award from any college within this time frame. A postsecondary enrollment is considered a Fall term if it begins between August 1st to October 31st. The period of time between a student’s start date and the Fall term that is assessed for enrollment may vary since students may initially enroll in any term. This is done for two reasons: 1. requiring only Fall start dates reduces the sample size of students that can be considered in this analysis; 2. It is difficult to determine Fall-Fall, Winter-Winter, Spring-Spring, or Summer-Summer across the various postsecondary institutions in which students enrolled. If the student re-enrolled or earned an award at their initial postsecondary institution, they are also considered to have been retained. The initial postsecondary enrollment is defined as the earliest postsecondary enrollment recorded for a student that is after their high school graduation date. Postsecondary persistence is determined using enrollment records from NSWERS’s Nebraska public postsecondary partners in addition to NSC data.

Postsecondary graduation

Cohort: two cohorts are used in this analysis

- College going students at any Nebraska public institution and any National Student Clearinghouse (NSC) covered postsecondary institution.

- All Nebraska public high school students who did not transfer out of the Nebraska public school system or were deceased prior to high school graduation.

Operationalization: A student is considered a postsecondary graduate if they earned a postsecondary award within six years of their high school graduation date. We consider certificates, associate's degrees, and bachelor's degrees to determine postsecondary graduation. The data used to determine postsecondary award attainment is a combination of data from both NSWERS' public postsecondary partners and NSC data. The former covers awards earned at Nebraska public postsecondaries whereas the latter covers awards earned at Nebraska private postsecondary institutions or out of state postsecondary institutions.

Causal Analysis

In this report, estimating the effect of dual enrollment participation on the long-term educational outcomes describe in the previous section is the goal. Dual enrollment participation is slightly re-defined for the causal analysis to include only dual enrollment participation during eleventh and twelfth grades and measure student baseline variables between ninth to tenth grades. This restriction ensures that there is no overlap in time between the baseline variables and treatment. As such, any baseline differences are not due to the treatment. Also, the majority of dual enrollment participation occurs during students' junior and senior years.

Covariate balance

Students self-select to participate in dual enrollment. This can lead to confounded estimates of the effect of dual enrollment on educational outcomes since there may be student characteristics that determine dual enrollment participation in addition to the educational outcome. For example, participation in dual enrollment typically requires the student to have at least a 3.0 cumulative GPA. Since GPA is also positively related to all four educational outcomes evaluated in this report, one would expect estimates of the effect of dual enrollment on outcomes to upwardly biased when unadjusted for differences in baseline GPA. To adjust for baseline differences between the dual enrollment and non-dual enrollment participant groups, matching methods are used to achieve covariate balance. The choice of covariates and the thresholds used to determine baseline equivalence follow the most recent What Works Clearinghouse (WWC) guidelines for analysis of Quasi-Experimental Designs (QED) (1).

To satisfy baseline equivalence for QED, there must be differences of less than or equal to 0.05 standard deviations between the a set of relevant covariates. These covariates must includes at least (1):

1. A broad, approximately continuous, and standardized measure of student academic readiness, knowledge, or skills, AND
2. Baseline measures of at least two of the following for learners in the analytic sample:
 - a. A measure of socioeconomic status, such as parental or caregiver level of education or eligibility for need-based assistance or financial aid
 - b. Race or ethnicity
 - c. Dual language or English learner student status
 - d. Disability status
 - e. Disciplinary measures such as frequency of suspensions or referrals
 - f. Grade level, for students between kindergarten and grade 12, or else age

To meet the first requirement, the 9-10 grade GPA was included as a baseline covariate. To meet the second requirement, race, homeless status (SES status), special education status (disability status), and English language learner (ELL) status was included.

Additional baseline covariates included gender, whether the student was a single parent, if the student was highly mobile, immigrant status, ELL eligibility, high ability learner eligibility and participation, and the proportion of total enrolled days in which a student was absent between 9-10 grades.

To balance covariates, the MatchIt R package was used to create matched or weighted analysis data sets using propensity scores as a distance (2, 3). The propensity score models included the main effects of all of the previously described baseline covariates. The nearest neighbor 1-1 matching was first used to balance the data, however, this approach did not adequately balance the GPA and absenteeism baseline covariates. Next, generalized full matching was used to form a weighted sample (4). This is a method also uses propensity scores (PS) to form subclasses of different sizes which must contain at least one treatment and one control. These subclasses are formed to approximately minimize the largest within-subclass distance in PS. Weights are then calculated for each observation based on the subclass assignments. All the previously listed variables were included in the propensity score model to calculate distances for full matching. Furthermore, the expected graduation year was used as an exact matching variable so that subsequent estimates of the causal effect of dual enrollment can be made specific to each high school cohort.

This approach was successful at reducing standardized mean differences between the dual enrollment participant and non-participant groups to less than 0.05 standard deviations which is the threshold that satisfies WWC standards for baseline equivalence (1).

For these analyses, matched data sets were created for each of the four outcomes:

- High school graduation (2016 - 2023 expected graduation year cohorts)
 - Expected high school graduation year cohort. This data set is based on the NDE cohort (expected graduation year) which is used to calculate state high school graduation rates. This differs from the high school cohort used elsewhere in this report as students who transferred out from Nebraska public schools or died prior to high school graduation are excluded from the cohort.
- College going (2016 - 2021 expected graduation year cohorts)
 - Four-year high school graduates. This cohort is a subset of the high school cohort which includes only students who graduated within four years of entering high school.
- Postsecondary persistence (2016 - 2021 expected graduation year cohorts)
 - Two-year Nebraska college students. This includes all college students that enrolled at a two-year postsecondary in Nebraska within 16 months of high school graduation. This cohort is a subset of the high school cohort which includes only students who were college going.
 - Four-year Nebraska college students. This includes all college students that enrolled at a four-year postsecondary in Nebraska within 16 months of high school graduation. This cohort is a subset of the high school cohort which includes only students who were college going.
 - Four-year out-of-state college goers. This includes all college students that enrolled at an out-of-state four-year postsecondary within 16 months of high school graduation. This cohort is a subset of the high school cohort which includes only students who were college going.

Note: There is no cohort for two-year out-of-state college going students because of low sample size. Furthermore, in cases where a college going student is concurrently enrolled at both a two-year and a four-year institution, the student is assigned to the four-year cohort.

- Postsecondary graduation (2016 - 2017 expected graduation year cohorts)
 - The expected high school graduation year cohort used for the high school graduation outcome. This cohort is used to provide an estimate of the effect of dual enrollment on all the steps leading up to college graduation, i.e., high school graduation, college enrollment, college persistence, and degree completion.
 - All three cohorts used in postsecondary persistence. These cohorts are used to estimate the effect of dual enrollment on postsecondary graduation excluding any effects of dual enrollment on high school graduation or college enrollment.

Note: the cohort years for postsecondary graduation are limited to expected high school graduates from the 2016 and 2017 cohorts as postsecondary graduation is tracked for six years after high school graduation in this study.

Baseline equivalence and analytic sample size

In this section, evidence is presented that the four analytic samples used in this report satisfy WWC standards for baseline equivalence (1). The tables include measures comparing the baseline covariates before (Un.) and after adjustment (Adj.) by generalized full matching. The measures of imbalance include the difference between intervention and non-intervention groups (expressed in standard deviations for continuous variables and as the difference in proportion for binary variables) which should be less than or equal to 0.05 when there is balance in the mean value of the variable between groups; the variance ratio for continuous variables which will be close to one when the variances are similar between groups, and the Kolmogorov-Smirnov test statistic, which will be close to zero when the distribution of the variable is similar between groups.

All standardized mean differences were less than 0.05 standard deviations for all adjusted analytic samples, meeting WWC standards for baseline equivalence.

Tables are presented below on the sample sizes for treated and control subjects before and after matching. The effect sample size of the control group is smaller across all four analytic data sets. This is a result of down weighting the control subjects which are least like treated subjects.

High school graduation - Expected high school graduation year cohort

Table 2: Covariate balance - expected high school graduation year cohort

Variable	Variable Type	Diff. Un. (sd)	Var. Ratio.	KS Un.	Diff. Adj. (sd)	Var. Ratio. Adj.	KS Adj.
distance	Distance	1.115	0.754	0.397	0.000	1.000	0.001
race AM	Binary	-0.013	NA	0.013	0.000	NA	0.000
race AS	Binary	-0.009	NA	0.009	-0.001	NA	0.001
race BL	Binary	-0.056	NA	0.056	-0.001	NA	0.001
race HIS	Binary	-0.068	NA	0.068	0.000	NA	0.000
race MTO	Binary	0.014	NA	0.014	-0.004	NA	0.004
race PI	Binary	-0.001	NA	0.001	0.000	NA	0.000
race WH	Binary	0.133	NA	0.133	0.007	NA	0.007
gender M	Binary	-0.124	NA	0.124	0.009	NA	0.009
single parent 2	Binary	0.003	NA	0.003	0.000	NA	0.000
homeless youth indicator 2	Binary	0.017	NA	0.017	0.000	NA	0.000
highly mobile indicator 2	Binary	0.067	NA	0.067	0.001	NA	0.001
immigrant indicator 0	Binary	0.037	NA	0.037	0.000	NA	0.000
immigrant indicator 1	Binary	-0.009	NA	0.009	0.000	NA	0.000
immigrant indicator 2	Binary	-0.015	NA	0.015	0.000	NA	0.000
immigrant indicator 3	Binary	-0.014	NA	0.014	0.000	NA	0.000
el eligibility 2	Binary	0.042	NA	0.042	0.000	NA	0.000
sped participation 2	Binary	0.123	NA	0.123	0.004	NA	0.004
high ability learner eligibility 2	Binary	-0.142	NA	0.142	-0.002	NA	0.002
high ability learner participant 2	Binary	-0.134	NA	0.134	-0.002	NA	0.002
proportion absent	Contin.	-0.762	0.227	0.184	-0.003	0.909	0.016
mean hs gpa	Contin.	1.177	0.476	0.373	-0.002	0.986	0.006
expected graduation year 2016	Binary	-0.021	NA	0.021	0.000	NA	0.000

Variable	Variable Type	Diff. Un. (sd)	Var. Ratio. Un.	KS Un.	Diff. Adj. (sd)	Var. Ratio. Adj.	KS Adj.
expected graduation year 2017	Binary	-0.013	NA	0.013	0.000	NA	0.000
expected graduation year 2018	Binary	0.003	NA	0.003	0.000	NA	0.000
expected graduation year 2019	Binary	-0.006	NA	0.006	0.000	NA	0.000
expected graduation year 2020	Binary	0.005	NA	0.005	0.000	NA	0.000
expected graduation year 2021	Binary	0.009	NA	0.009	0.000	NA	0.000
expected graduation year 2022	Binary	0.022	NA	0.022	0.000	NA	0.000

COVARIATE BALANCE

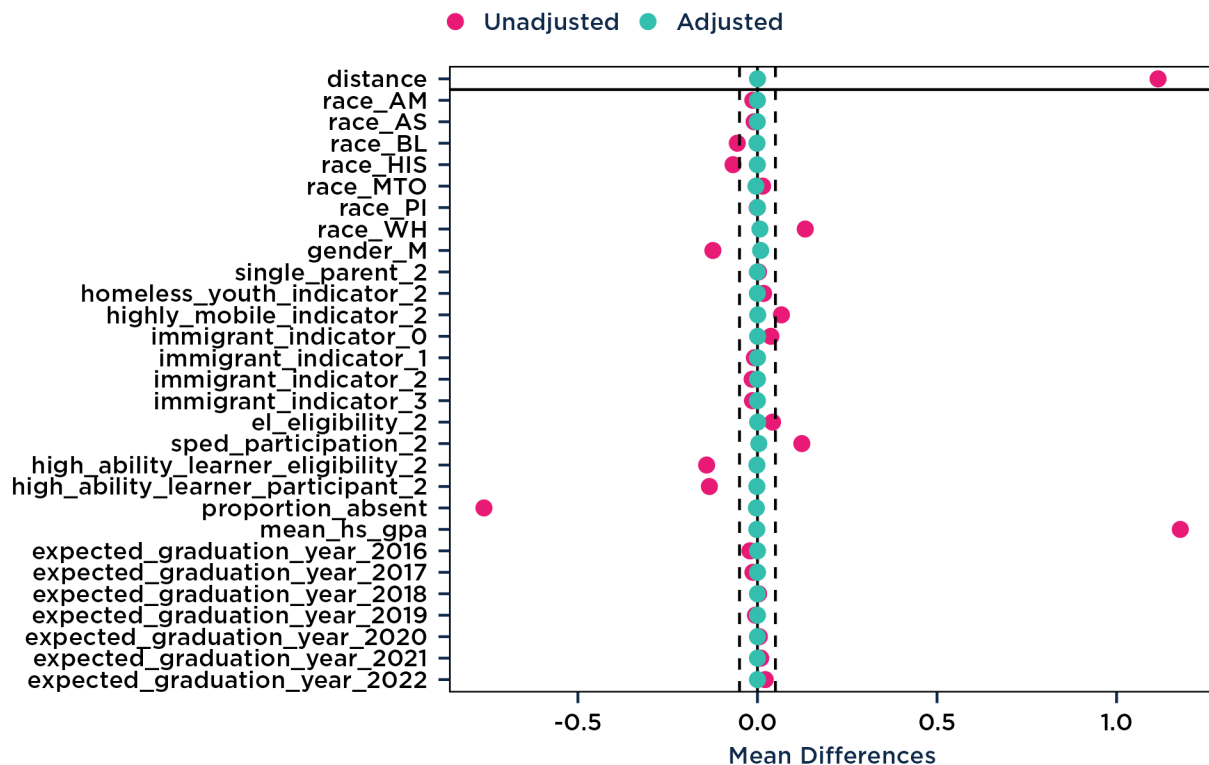


Table 3: Sample size - expected high school graduation year cohort

Observations	Control	Treated
All (ESS)	81747.0	46780
All (Unweighted)	81747.0	46780
Matched (ESS)	21146.3	46780
Matched (Unweighted)	81747.0	46780
Unmatched	0.0	0

College going - 4 year high school graduates

Table 4: Covariate balance - 4 year high school graduates cohort

Variable	Variable Type	Diff. Un. (sd)	Var. Ratio. Un.	KS Un.	Diff. Adj. (sd)	Var. Ratio. Adj.	KS Adj.
distance	Distance	0.932	0.793	0.345	0.000	1.000	0.001
race AM	Binary	-0.010	NA	0.010	-0.001	NA	0.001
race AS	Binary	-0.008	NA	0.008	0.001	NA	0.001
race BL	Binary	-0.047	NA	0.047	0.000	NA	0.000
race HIS	Binary	-0.045	NA	0.045	-0.002	NA	0.002
race MTO	Binary	0.012	NA	0.012	0.002	NA	0.002
race PI	Binary	-0.001	NA	0.001	0.000	NA	0.000
race WH	Binary	0.099	NA	0.099	-0.001	NA	0.001
gender M	Binary	-0.108	NA	0.108	-0.001	NA	0.001
single parent 2	Binary	0.001	NA	0.001	0.000	NA	0.000
homeless youth indicator 2	Binary	0.008	NA	0.008	0.000	NA	0.000
highly mobile indicator 2	Binary	0.035	NA	0.035	0.000	NA	0.000
immigrant indicator 0	Binary	0.022	NA	0.022	0.001	NA	0.001
immigrant indicator 1	Binary	-0.003	NA	0.003	0.000	NA	0.000
immigrant indicator 2	Binary	-0.006	NA	0.006	0.000	NA	0.000
immigrant indicator 3	Binary	-0.013	NA	0.013	-0.001	NA	0.001
el eligibility 2	Binary	0.021	NA	0.021	0.001	NA	0.001
sped participation 2	Binary	0.087	NA	0.087	-0.002	NA	0.002
high ability learner eligibility 2	Binary	-0.113	NA	0.113	-0.004	NA	0.004
high ability learner participant 2	Binary	-0.105	NA	0.105	-0.005	NA	0.005
proportion absent	Contin.	-0.383	0.492	0.127	-0.002	0.957	0.008
mean hs gpa	Contin.	0.940	0.617	0.331	0.000	1.000	0.001
expected graduation year 2016	Binary	-0.025	NA	0.025	0.000	NA	0.000
expected graduation year 2017	Binary	-0.014	NA	0.014	0.000	NA	0.000
expected graduation year 2018	Binary	0.004	NA	0.004	0.000	NA	0.000
expected graduation year 2019	Binary	-0.003	NA	0.003	0.000	NA	0.000
expected graduation year 2020	Binary	0.016	NA	0.016	0.000	NA	0.000
expected graduation year 2021	Binary	0.022	NA	0.022	0.000	NA	0.000

COVARIATE BALANCE

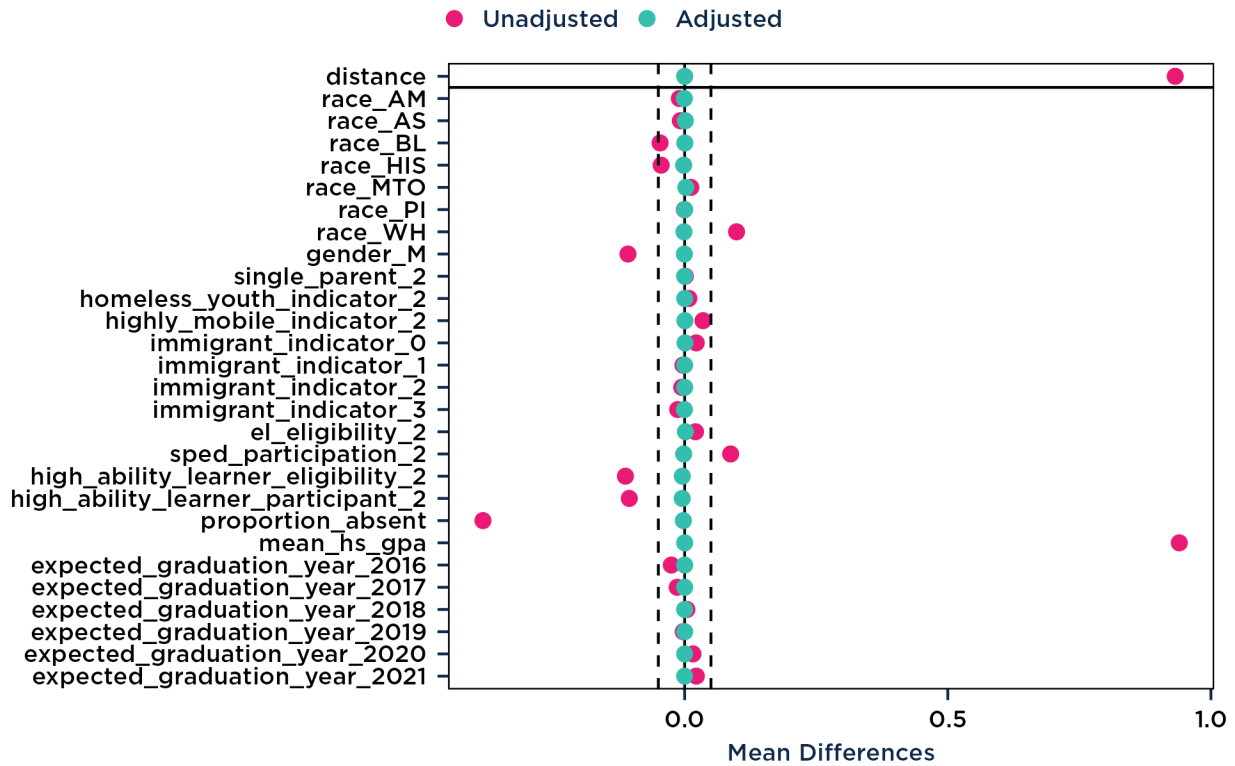


Table 5: Sample size - four year high school graduation cohort

Observations	Control	Treated
All (ESS)	58264.0	38347
All (Unweighted)	58264.0	38347
Matched (ESS)	17264.6	38347
Matched (Unweighted)	58264.0	38347
Unmatched	0.0	0

Postsecondary persistence - two-year Nebraska college goers

Table 6: Covariate balance - two-year Nebraska college goers cohort

Variable	Variable Type	Diff. Un. (sd)	Var. Ratio. Un.	KS Un.	Diff. Adj. (sd)	Var. Ratio. Adj.	KS Adj.
distance	Distance	0.799	0.939	0.305	0.000	1.000	0.004
race AM	Binary	-0.011	NA	0.011	0.000	NA	0.000
race AS	Binary	-0.012	NA	0.012	0.000	NA	0.000
race BL	Binary	-0.037	NA	0.037	-0.002	NA	0.002
race HIS	Binary	-0.035	NA	0.035	0.001	NA	0.001
race MTO	Binary	-0.038	NA	0.038	0.006	NA	0.006
race PI	Binary	0.000	NA	0.000	0.000	NA	0.000
race WH	Binary	0.133	NA	0.133	-0.005	NA	0.005
gender M	Binary	-0.074	NA	0.074	-0.008	NA	0.008

Variable	Variable Type	Diff. Un. (sd)	Var. Ratio.	KS Un.	KS Un.	Diff. Adj. (sd)	Var. Ratio. Adj.	KS Adj.
single parent 2	Binary	0.001	NA	0.001	0.001	0.000	NA	0.000
homeless youth indicator 2	Binary	0.007	NA	0.007	0.007	0.000	NA	0.000
highly mobile indicator 2	Binary	0.031	NA	0.031	0.031	-0.002	NA	0.002
immigrant indicator 0	Binary	0.038	NA	0.038	0.038	0.001	NA	0.001
immigrant indicator 1	Binary	-0.005	NA	0.005	0.005	0.000	NA	0.000
immigrant indicator 2	Binary	-0.012	NA	0.012	0.012	-0.001	NA	0.001
immigrant indicator 3	Binary	-0.021	NA	0.021	0.021	0.000	NA	0.000
el eligibility 2	Binary	0.034	NA	0.034	0.034	0.002	NA	0.002
sped participation 2	Binary	0.071	NA	0.071	0.071	-0.003	NA	0.003
high ability learner eligibility 2	Binary	-0.053	NA	0.053	0.053	-0.006	NA	0.006
high ability learner participant 2	Binary	-0.047	NA	0.047	0.047	-0.003	NA	0.003
proportion absent	Contin.	-0.294	0.523	0.099	0.099	0.010	0.971	0.026
mean hs gpa	Contin.	0.760	0.783	0.274	0.274	-0.001	0.994	0.006
expected graduation year 2016	Binary	-0.036	NA	0.036	0.036	0.000	NA	0.000
expected graduation year 2017	Binary	-0.025	NA	0.025	0.025	0.000	NA	0.000
expected graduation year 2018	Binary	-0.005	NA	0.005	0.005	0.000	NA	0.000
expected graduation year 2019	Binary	0.005	NA	0.005	0.005	0.000	NA	0.000
expected graduation year 2020	Binary	0.030	NA	0.030	0.030	0.000	NA	0.000
expected graduation year 2021	Binary	0.032	NA	0.032	0.032	0.000	NA	0.000

COVARIATE BALANCE

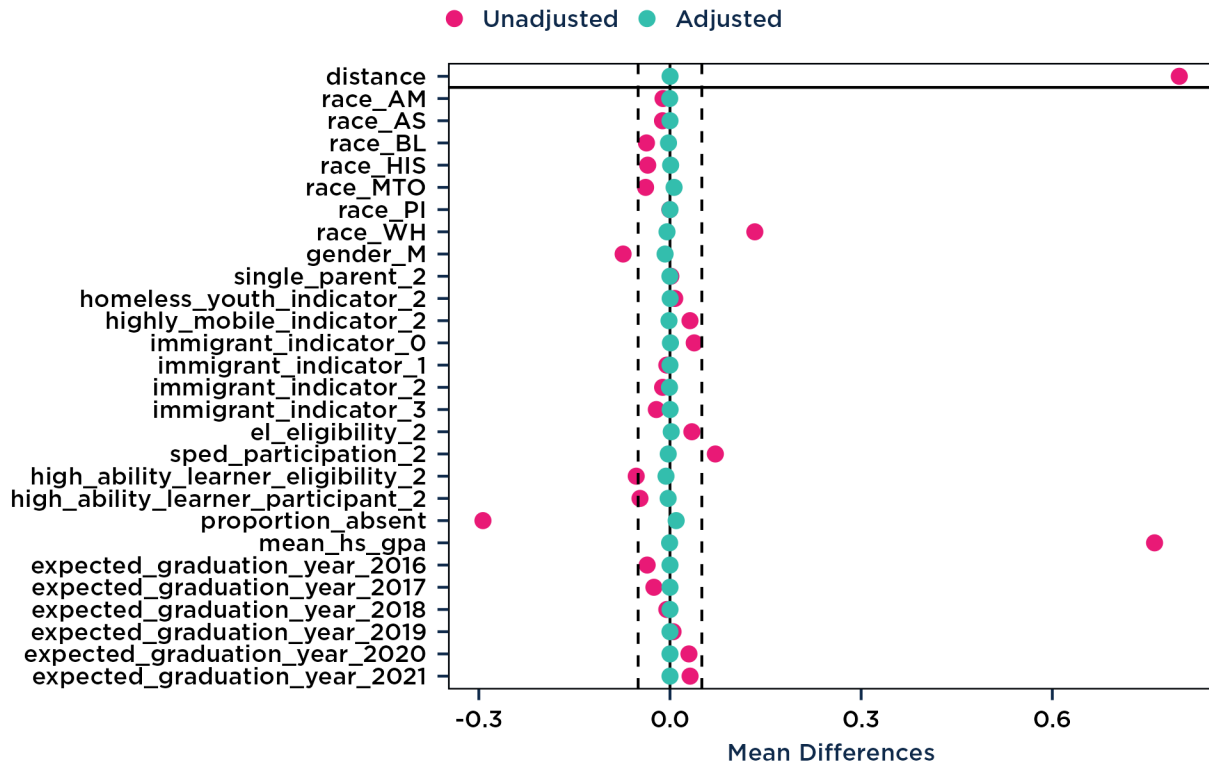


Table 7: Sample size - two-year Nebraska college goers cohort

Observations	Control	Treated
All (ESS)	13888.0	9905
All (Unweighted)	13888.0	9905
Matched (ESS)	4004.2	9905
Matched (Unweighted)	13888.0	9905
Unmatched	0.0	0

Postsecondary persistence - four-year Nebraska college goers

Table 8: Covariate balance - four-year Nebraska college goers cohort

Variable	Variable Type	Diff. Un. (sd)	Var. Ratio. Un.	KS Un.	Diff. Adj. (sd)	Var. Ratio. Adj.	KS Adj.
distance	Distance	0.735	0.668	0.263	0.000	1.000	0.001
race AM	Binary	-0.003	NA	0.003	0.000	NA	0.000
race AS	Binary	-0.015	NA	0.015	0.000	NA	0.000
race BL	Binary	-0.035	NA	0.035	-0.002	NA	0.002
race HIS	Binary	-0.012	NA	0.012	0.003	NA	0.003
race MTO	Binary	0.006	NA	0.006	-0.007	NA	0.007
race PI	Binary	0.000	NA	0.000	0.000	NA	0.000
race WH	Binary	0.059	NA	0.059	0.006	NA	0.006

Variable	Variable Type	Diff. Un. (sd)	Var. Ratio.	KS Un.	KS Un.	Diff. Adj. (sd)	Var. Ratio. Adj.	KS Adj.
gender M	Binary	-0.081	NA	0.081	0.081	0.012	NA	0.012
single parent 2	Binary	0.000	NA	0.000	0.000	0.000	NA	0.000
homeless youth indicator 2	Binary	0.003	NA	0.003	0.003	0.000	NA	0.000
highly mobile indicator 2	Binary	0.016	NA	0.016	0.016	0.001	NA	0.001
immigrant indicator 0	Binary	0.011	NA	0.011	0.011	0.004	NA	0.004
immigrant indicator 1	Binary	-0.002	NA	0.002	0.002	0.000	NA	0.000
immigrant indicator 2	Binary	-0.003	NA	0.003	0.003	-0.001	NA	0.001
immigrant indicator 3	Binary	-0.006	NA	0.006	0.006	-0.003	NA	0.003
el eligibility 2	Binary	0.010	NA	0.010	0.010	0.001	NA	0.001
sped participation 2	Binary	0.025	NA	0.025	0.025	0.000	NA	0.000
high ability learner eligibility 2	Binary	-0.061	NA	0.061	0.061	-0.011	NA	0.011
high ability learner participant 2	Binary	-0.053	NA	0.053	0.053	-0.009	NA	0.009
proportion absent	Contin.	-0.146	0.721	0.053	0.053	-0.014	0.785	0.013
mean hs gpa	Contin.	0.701	0.612	0.246	0.246	0.006	1.005	0.015
expected graduation year 2016	Binary	-0.025	NA	0.025	0.025	0.000	NA	0.000
expected graduation year 2017	Binary	-0.022	NA	0.022	0.022	0.000	NA	0.000
expected graduation year 2018	Binary	-0.001	NA	0.001	0.001	0.000	NA	0.000
expected graduation year 2019	Binary	-0.002	NA	0.002	0.002	0.000	NA	0.000
expected graduation year 2020	Binary	0.021	NA	0.021	0.021	0.000	NA	0.000
expected graduation year 2021	Binary	0.029	NA	0.029	0.029	0.000	NA	0.000

COVARIATE BALANCE

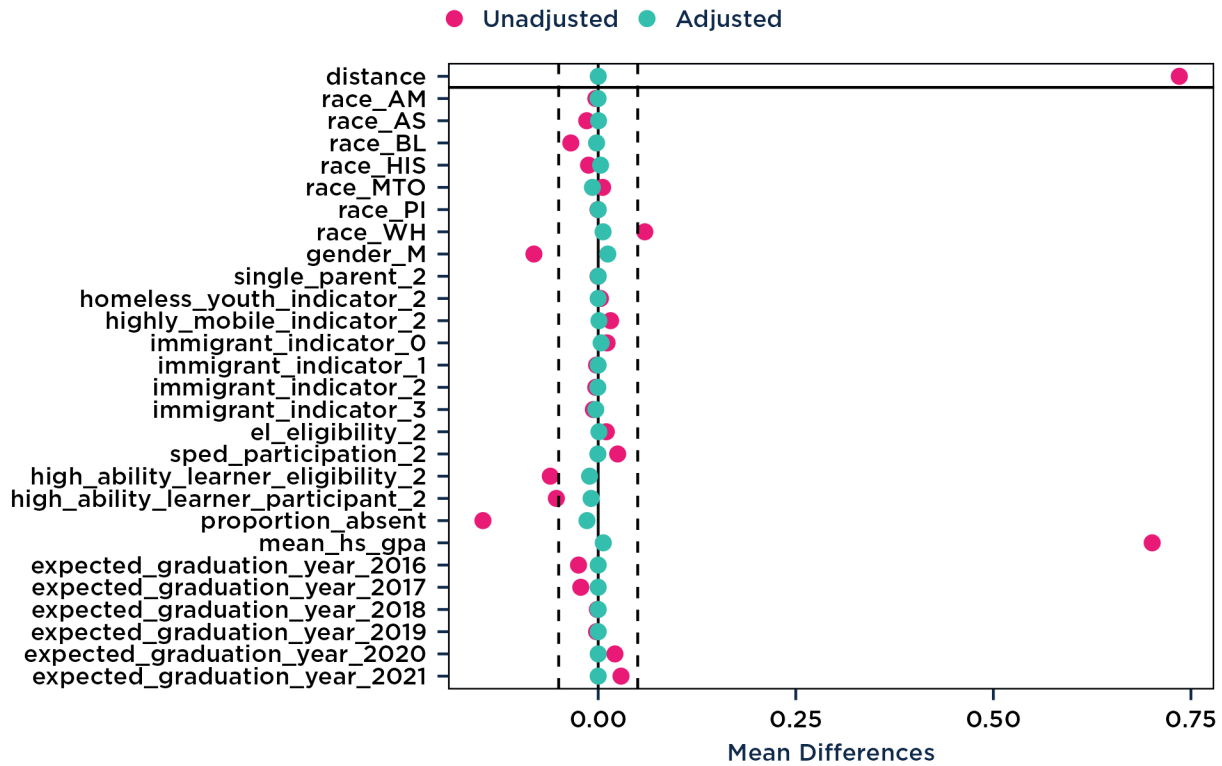


Table 9: Sample size - four-year Nebraska college goers cohort

Observations	Control	Treated
All (ESS)	16651.0	18925
All (Unweighted)	16651.0	18925
Matched (ESS)	6452.5	18925
Matched (Unweighted)	16651.0	18925
Unmatched	0.0	0

Postsecondary persistence - four-year out-of-state college goers

Table 10: Covariate balance - four-year out-of-state college goers cohort

Variable	Variable Type	Diff. Un. (sd)	Var. Ratio. Un.	KS Un.	Diff. Adj. (sd)	Var. Ratio. Adj.	KS Adj.
distance	Distance	0.637	0.733	0.229	0.001	1.004	0.005
race AM	Binary	-0.008	NA	0.008	0.000	NA	0.000
race AS	Binary	-0.026	NA	0.026	0.002	NA	0.002
race BL	Binary	-0.027	NA	0.027	-0.004	NA	0.004
race HIS	Binary	-0.019	NA	0.019	0.000	NA	0.000
race MTO	Binary	0.038	NA	0.038	0.001	NA	0.001
race PI	Binary	0.000	NA	0.000	0.000	NA	0.000
race WH	Binary	0.043	NA	0.043	0.002	NA	0.002

Variable	Variable Type	Diff. Un. (sd)	Var. Ratio.	KS Un.	Diff. Adj. (sd)	Var. Ratio. Adj.	KS Adj.
gender M	Binary	-0.051	NA	0.051	0.004	NA	0.004
single parent 2	Binary	0.000	NA	0.000	0.000	NA	0.000
homeless youth indicator 2	Binary	0.000	NA	0.000	-0.001	NA	0.001
highly mobile indicator 2	Binary	0.015	NA	0.015	-0.001	NA	0.001
immigrant indicator 0	Binary	0.006	NA	0.006	0.001	NA	0.001
immigrant indicator 1	Binary	-0.001	NA	0.001	0.000	NA	0.000
immigrant indicator 2	Binary	-0.001	NA	0.001	0.000	NA	0.000
immigrant indicator 3	Binary	-0.005	NA	0.005	-0.001	NA	0.001
el eligibility 2	Binary	0.004	NA	0.004	0.000	NA	0.000
sped participation 2	Binary	0.017	NA	0.017	0.000	NA	0.000
high ability learner eligibility 2	Binary	0.001	NA	0.001	-0.009	NA	0.009
high ability learner participant 2	Binary	0.010	NA	0.010	-0.007	NA	0.007
proportion absent	Contin.	-0.140	0.663	0.045	0.013	0.995	0.024
mean hs gpa	Contin.	0.568	0.518	0.179	0.002	0.990	0.009
expected graduation year 2016	Binary	-0.034	NA	0.034	0.000	NA	0.000
expected graduation year 2017	Binary	-0.004	NA	0.004	0.000	NA	0.000
expected graduation year 2018	Binary	0.016	NA	0.016	0.000	NA	0.000
expected graduation year 2019	Binary	-0.028	NA	0.028	0.000	NA	0.000
expected graduation year 2020	Binary	-0.001	NA	0.001	0.000	NA	0.000
expected graduation year 2021	Binary	0.051	NA	0.051	0.000	NA	0.000

COVARIATE BALANCE

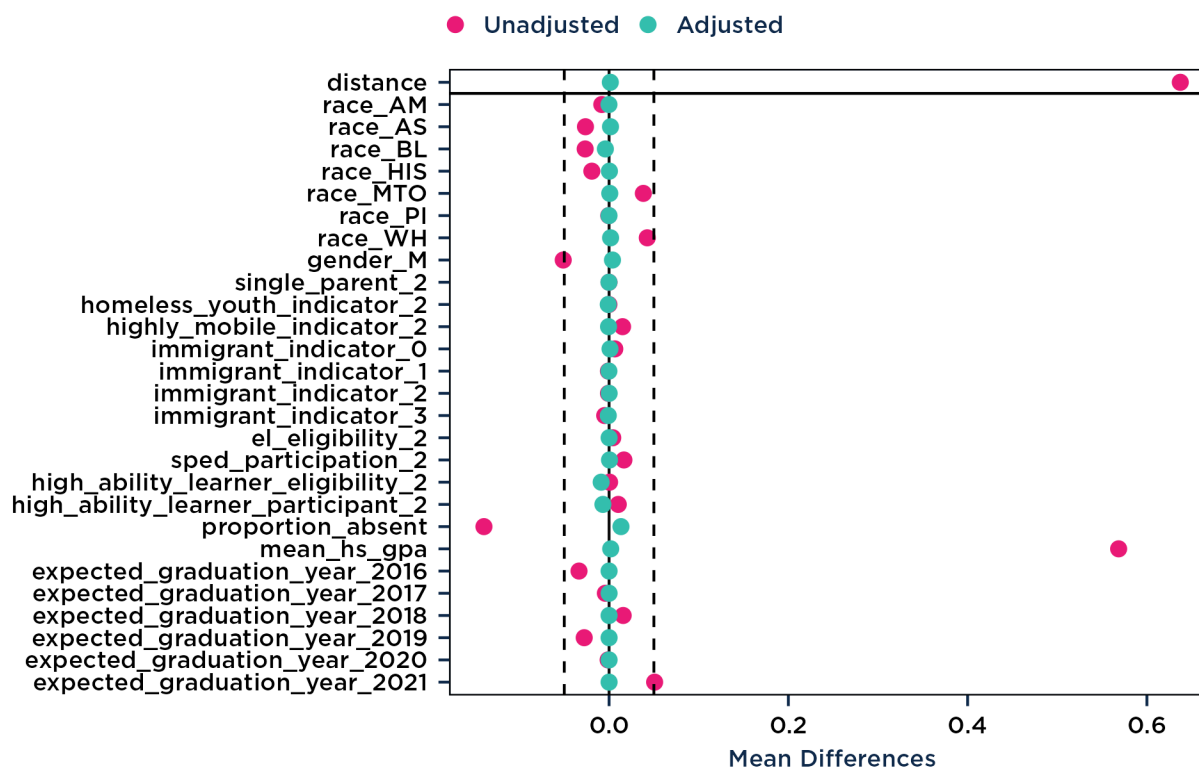


Table 11: Sample size - four-year out-of-state college goers cohort

Observations	Control	Treated
All (ESS)	5095.0	3720
All (Unweighted)	5095.0	3720
Matched (ESS)	1932.8	3720
Matched (Unweighted)	5095.0	3720
Unmatched	0.0	0

Postsecondary graduation - expected high school graduation year cohort

Table 12: Covariate balance - expected high school graduation year cohort

Variable	Variable Type	Diff. Un. (sd)	Var. Ratio. Un.	KS Un.	Diff. Adj. (sd)	Var. Ratio. Adj.	KS Adj.
distance	Distance	1.083	0.831	0.398	0.000	1.000	0.001
race AM	Binary	-0.015	NA	0.015	0.000	NA	0.000
race AS	Binary	-0.009	NA	0.009	0.000	NA	0.000
race BL	Binary	-0.057	NA	0.057	-0.001	NA	0.001
race HIS	Binary	-0.060	NA	0.060	0.001	NA	0.001
race MTO	Binary	0.022	NA	0.022	0.000	NA	0.000
race PI	Binary	-0.001	NA	0.001	0.000	NA	0.000
race WH	Binary	0.120	NA	0.120	0.001	NA	0.001

Variable	Variable Type	Diff. Un. (sd)	Var. Ratio. Un.	KS Un.	Diff. Adj. (sd)	Var. Ratio. Adj.	KS Adj.
gender M	Binary	-0.123	NA	0.123	0.009	NA	0.009
single parent 2	Binary	0.003	NA	0.003	0.000	NA	0.000
homeless youth indicator 2	Binary	0.015	NA	0.015	0.000	NA	0.000
highly mobile indicator 2	Binary	0.074	NA	0.074	0.001	NA	0.001
immigrant indicator 0	Binary	0.031	NA	0.031	0.003	NA	0.003
immigrant indicator 1	Binary	-0.006	NA	0.006	0.000	NA	0.000
immigrant indicator 2	Binary	-0.011	NA	0.011	0.000	NA	0.000
immigrant indicator 3	Binary	-0.014	NA	0.014	-0.003	NA	0.003
el eligibility 2	Binary	0.031	NA	0.031	0.001	NA	0.001
sped participation 2	Binary	0.122	NA	0.122	0.002	NA	0.002
high ability learner eligibility 2	Binary	-0.148	NA	0.148	0.003	NA	0.003
high ability learner participant 2	Binary	-0.142	NA	0.142	0.001	NA	0.001
proportion absent	Contin.	-0.792	0.236	0.198	0.000	0.944	0.013
mean hs gpa	Contin.	1.149	0.505	0.375	-0.003	0.982	0.010
expected graduation year 2017	Binary	0.016	NA	0.016	0.000	NA	0.000

COVARIATE BALANCE

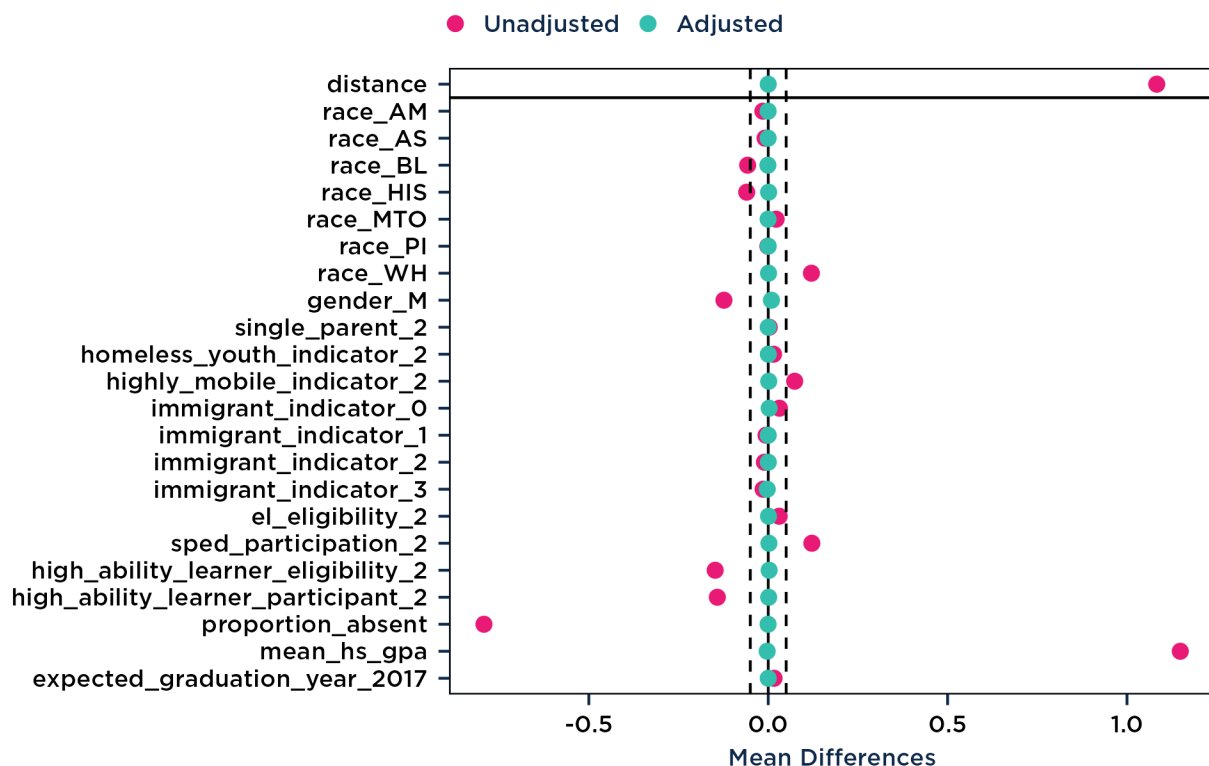


Table 13: Sample size - expected high school graduation year cohort

Observations	Control	Treated
All (ESS)	26243.0	11760
All (Unweighted)	26243.0	11760
Matched (ESS)	6711.1	11760
Matched (Unweighted)	26243.0	11760
Unmatched	0.0	0

Postsecondary graduation - two-year Nebraska college goers

Table 14: Covariate balance - two-year Nebraska college goers cohort

Variable	Variable Type	Diff. Un. (sd)	Var. Ratio. Un.	KS Un.	Diff. Adj. (sd)	Var. Ratio. Adj.	KS Adj.
distance	Distance	0.774	1.068	0.309	0.000	1.000	0.006
race AM	Binary	-0.009	NA	0.009	-0.001	NA	0.001
race AS	Binary	-0.014	NA	0.014	-0.001	NA	0.001
race BL	Binary	-0.038	NA	0.038	-0.001	NA	0.001
race HIS	Binary	-0.035	NA	0.035	0.001	NA	0.001
race MTO	Binary	-0.020	NA	0.020	-0.001	NA	0.001
race PI	Binary	0.000	NA	0.000	0.000	NA	0.000
race WH	Binary	0.115	NA	0.115	0.004	NA	0.004
gender M	Binary	-0.108	NA	0.108	0.015	NA	0.015
single parent 2	Binary	0.000	NA	0.000	-0.001	NA	0.001
homeless youth indicator 2	Binary	0.006	NA	0.006	0.000	NA	0.000
highly mobile indicator 2	Binary	0.031	NA	0.031	0.002	NA	0.002
immigrant indicator 0	Binary	0.030	NA	0.030	0.004	NA	0.004
immigrant indicator 1	Binary	-0.003	NA	0.003	0.000	NA	0.000
immigrant indicator 2	Binary	-0.009	NA	0.009	-0.001	NA	0.001
immigrant indicator 3	Binary	-0.018	NA	0.018	-0.003	NA	0.003
el eligibility 2	Binary	0.023	NA	0.023	0.007	NA	0.007
sped participation 2	Binary	0.077	NA	0.077	0.002	NA	0.002
high ability learner eligibility 2	Binary	-0.052	NA	0.052	0.002	NA	0.002
high ability learner participant 2	Binary	-0.047	NA	0.047	0.002	NA	0.002
proportion absent	Contin.	-0.323	0.531	0.116	-0.004	1.001	0.027
mean hs gpa	Contin.	0.753	0.819	0.276	-0.005	0.990	0.020
expected graduation year 2017	Binary	0.017	NA	0.017	0.000	NA	0.000

COVARIATE BALANCE

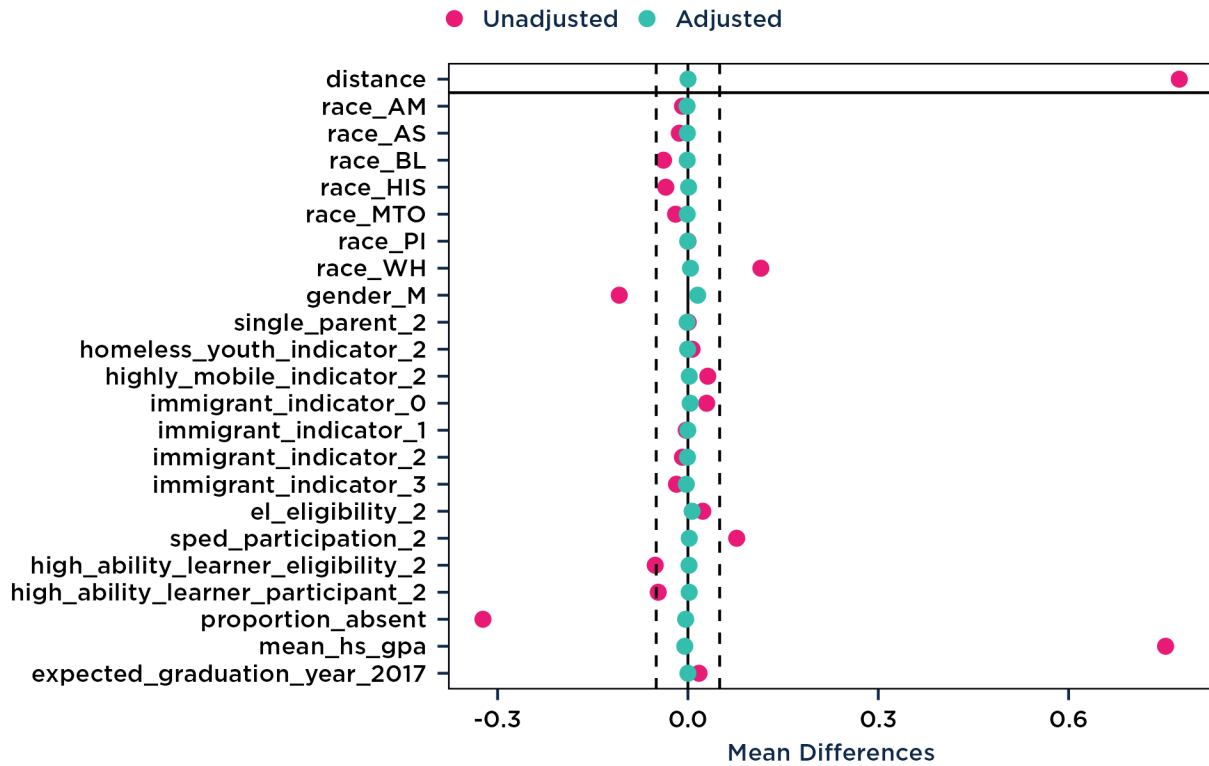


Table 15: Sample size - two-year Nebraska college goers cohort

Observations	Control	Treated
All (ESS)	4903.0	2892
All (Unweighted)	4903.0	2892
Matched (ESS)	1429.2	2892
Matched (Unweighted)	4903.0	2892
Unmatched	0.0	0

Postsecondary graduation - four-year Nebraska college goers

Table 16: Covariate balance - four-year Nebraska college goers cohort

Variable	Variable Type	Diff. Un. (sd)	Var. Ratio. Un.	KS Un.	Diff. Adj. (sd)	Var. Ratio. Adj.	KS Adj.
distance	Distance	0.732	0.696	0.272	0.001	1.001	0.003
race AM	Binary	-0.002	NA	0.002	0.000	NA	0.000
race AS	Binary	-0.012	NA	0.012	0.002	NA	0.002
race BL	Binary	-0.033	NA	0.033	-0.002	NA	0.002
race HIS	Binary	-0.008	NA	0.008	0.006	NA	0.006
race MTO	Binary	0.008	NA	0.008	-0.009	NA	0.009
race PI	Binary	0.000	NA	0.000	0.000	NA	0.000
race WH	Binary	0.048	NA	0.048	0.003	NA	0.003

Variable	Variable Type	Diff. Un. (sd)	Var. Ratio.	KS Un.	KS Adj.	Diff. Adj. (sd)	Var. Ratio. Adj.	KS Adj.
gender M	Binary	-0.084	NA	0.084	0.007	0.007	NA	0.007
single parent 2	Binary	-0.001	NA	0.001	-0.001	-0.001	NA	0.001
homeless youth indicator 2	Binary	0.003	NA	0.003	0.000	0.000	NA	0.000
highly mobile indicator 2	Binary	0.017	NA	0.017	0.001	0.001	NA	0.001
immigrant indicator 0	Binary	0.013	NA	0.013	-0.001	-0.001	NA	0.001
immigrant indicator 1	Binary	-0.002	NA	0.002	0.000	0.000	NA	0.000
immigrant indicator 2	Binary	-0.004	NA	0.004	0.000	0.000	NA	0.000
immigrant indicator 3	Binary	-0.007	NA	0.007	0.002	0.002	NA	0.002
el eligibility 2	Binary	0.009	NA	0.009	0.001	0.001	NA	0.001
sped participation 2	Binary	0.026	NA	0.026	0.000	0.000	NA	0.000
high ability learner eligibility 2	Binary	-0.054	NA	0.054	-0.010	-0.010	NA	0.010
high ability learner participant 2	Binary	-0.051	NA	0.051	-0.011	-0.011	NA	0.011
proportion absent	Contin.	-0.152	0.808	0.069	0.008	0.008	1.110	0.010
mean hs gpa	Contin.	0.687	0.643	0.244	0.006	0.006	1.026	0.013
expected graduation year 2017	Binary	0.006	NA	0.006	0.000	0.000	NA	0.000

COVARIATE BALANCE

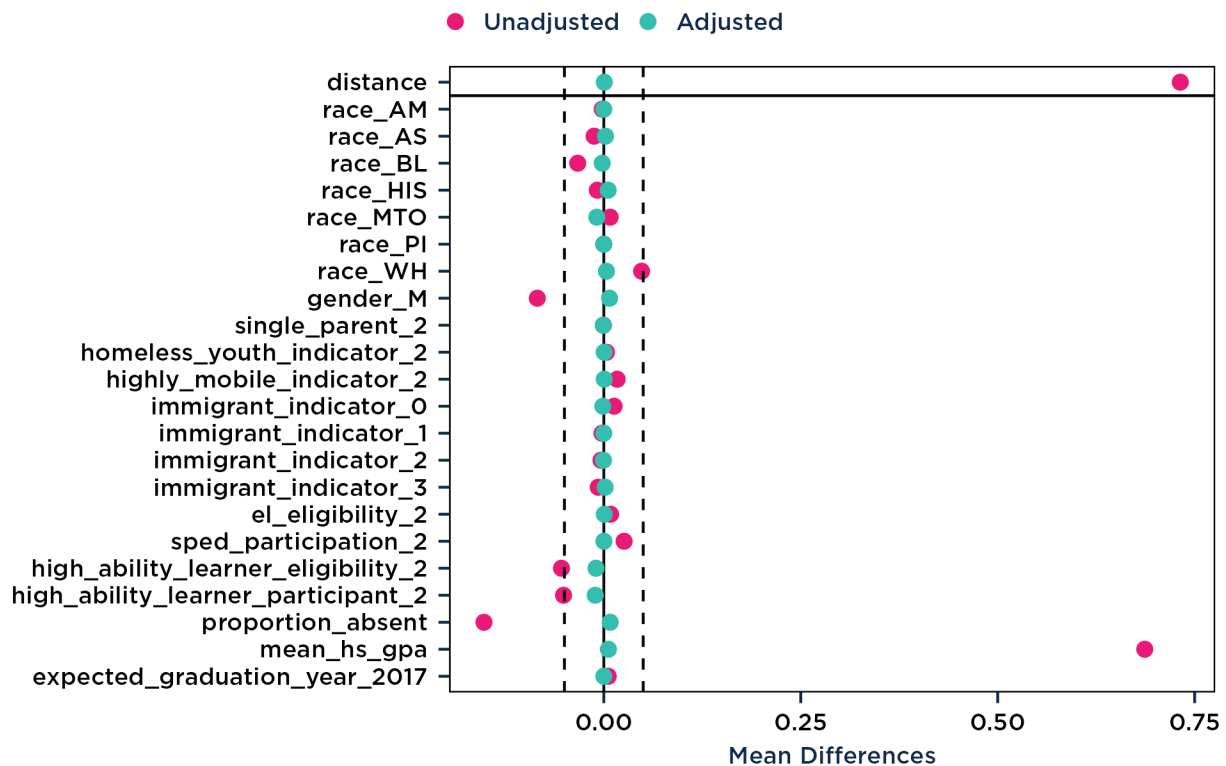


Table 17: Sample size - four-year Nebraska college goers cohort

Observations	Control	Treated
All (ESS)	5825.0	5732
All (Unweighted)	5825.0	5732
Matched (ESS)	2262.8	5732
Matched (Unweighted)	5825.0	5732
Unmatched	0.0	0

Postsecondary graduation - four-year out-of-state college goers

Table 18: Covariate balance - four-year out-of-state college goers cohort

Variable	Variable Type	Diff. Un. (sd)	Var. Ratio. Un.	KS Un.	Diff. Adj. (sd)	Var. Ratio. Adj.	KS Adj.
distance	Distance	0.651	0.817	0.237	0.004	1.015	0.013
race AM	Binary	-0.011	NA	0.011	-0.001	NA	0.001
race AS	Binary	-0.016	NA	0.016	0.000	NA	0.000
race BL	Binary	-0.024	NA	0.024	-0.005	NA	0.005
race HIS	Binary	-0.009	NA	0.009	0.000	NA	0.000
race MTO	Binary	0.063	NA	0.063	-0.008	NA	0.008
race PI	Binary	-0.001	NA	0.001	0.000	NA	0.000
race WH	Binary	-0.002	NA	0.002	0.014	NA	0.014
gender M	Binary	-0.064	NA	0.064	0.010	NA	0.010
homeless youth indicator 2	Binary	0.001	NA	0.001	0.000	NA	0.000
highly mobile indicator 2	Binary	0.013	NA	0.013	-0.005	NA	0.005
immigrant indicator 0	Binary	0.009	NA	0.009	0.001	NA	0.001
immigrant indicator 2	Binary	-0.001	NA	0.001	0.000	NA	0.000
immigrant indicator 3	Binary	-0.009	NA	0.009	-0.001	NA	0.001
el eligibility 2	Binary	0.001	NA	0.001	0.000	NA	0.000
sped participation 2	Binary	0.018	NA	0.018	0.006	NA	0.006
high ability learner eligibility 2	Binary	-0.017	NA	0.017	0.014	NA	0.014
high ability learner participant 2	Binary	-0.010	NA	0.010	0.018	NA	0.018
proportion absent	Contin.	-0.161	0.792	0.075	-0.022	1.051	0.037
mean hs gpa	Contin.	0.648	0.445	0.197	0.003	0.927	0.018
expected graduation year 2017	Binary	0.050	NA	0.050	0.000	NA	0.000

COVARIATE BALANCE

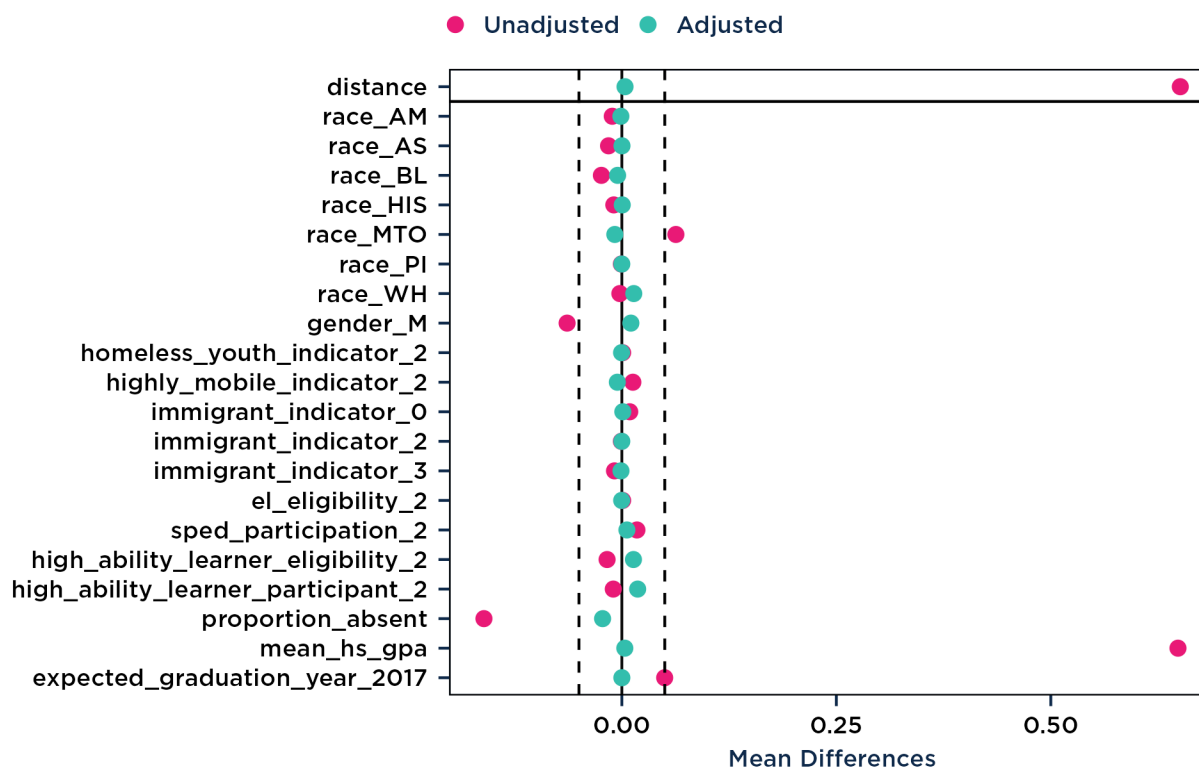


Table 19: Sample size - four-year out-of-state college goers cohort

Observations	Control	Treated
All (ESS)	1637.0	1055
All (Unweighted)	1637.0	1055
Matched (ESS)	574.4	1055
Matched (Unweighted)	1637.0	1055
Unmatched	0.0	0

Effect estimation In this report, the marginal average treatment effect on the treated (ATT) of dual enrollment participation during 11-12 grades on each outcome for each cohort year was estimated. This effect can be interpreted as the effect of dual enrollment participation among students that actually participated in dual enrollment during 11-12 grades. This was estimated using a generalized linear model with logit link that included main effects and interactions of dual enrollment participation with each of the variables used in propensity score model. All variables were coded as indicator variables except for the high school GPA and absenteeism.

$$\text{logit}(P(Y = 1)) = \beta_t T + \beta_{tx} T^T X + \beta_x X$$

- Y is the outcome (0 or 1)
- T is the treatment indicator for dual enrollment participation (0 or 1)
- X is the design matrix of covariates
- β_t the treatment main effect
- β_{tx} is the vector of treatment \times covariate coefficients

- β_x the vector of main effect estimates for the covariates

This inclusion of the propensity score model covariates in the regression model confers double-robustness to the estimation procedure. That is, the estimate is consistent if either the matching procedure sufficiently reduces covariate imbalance or if the outcome model is correct.

Marginal effect estimates of the effect of dual enrollment participation by g-computation via the `avg_comparisons()` function from the `margineffects` R package were produced (5). This method calculates the marginal ATT by generating potential outcomes for each treated subject from the fitted regression model which results in two potential outcomes for each subject, one under treatment and the other when untreated (counterfactual). The average potential outcome is calculated for each group, under treatment and when untreated. The contrast (i.e., risk ratio or risk difference) was calculated using these two estimates of the average potential outcomes.

Standard errors were calculated using the delta method to approximate the variance of the estimates after g-computation (5). Cluster-robust standard errors based on subclass membership obtained from the generalized full matching process are used as inputs to calculate the variance of the marginal effect.

Three standard types of effect size for binary outcomes were generated: risk ratio, risk difference, and odds ratio. Only the risk difference is presented in the main text. All three estimates are provided as supplementary data in this document.

- Risk ratio (RR) - The risk ratio is defined as the ratio of the estimated probability of success under treatment and probability of success in the control

$$- \hat{RR} = \frac{\hat{P}(y=1|t=1)}{\hat{P}(y=1|t=0)}.$$

- This can be interpreted as how many times more likely the outcome will be when a student participates in dual enrollment among those who participated. Inverting the risk ratio would show how likely the outcome would be if none of the treated students took dual enrollment. Note that this interpretation assumes that the student would not switch to enroll in alternatives to dual enrollment.

- Risk difference (RD) - The risk difference is the difference in the estimated probability of success between treatment and control. This estimate is provided in the main report.

$$- \hat{RD} = \hat{P}(y = 1|t = 1) - \hat{P}(y = 1|t = 0)$$

- This can be interpreted as the change in probability of an outcome when a student participates in dual enrollment among those who participated.

- Odds ratio (OR) - the odds ratio is the ratio of the odds of success under treatment (dual enrollment participant) and odds of success under the control condition (non-dual enrollment participant)

$$- \hat{OR} = \frac{\frac{\hat{P}(y=1|t=1)}{\hat{P}(y=0|t=1)}}{\frac{\hat{P}(y=1|t=0)}{\hat{P}(y=0|t=0)}}$$

Limitations When interpreting the results of the causal analysis, the following considerations should be made.

Incomplete dual enrollment participation data NSWERS postsecondary data records do not currently include transcript information for non-Nebraska public postsecondaries. This means that Nebraska public high school students who take dual enrollment at either private institutions, out of state institutions, or tribal colleges will not be counted as dual enrollees. This will likely bias the results of our estimates. It is not clear in which direction the results may be biased.

The modeling choice to omit students from Central Community College's (CCC) service area is one attempt at reducing this issue, since CCC data is not available for most cohort years.

This limitation impacts the interpretation of causal estimates to only be relevant to the effects of dual enrollment participation taken at Nebraska public postsecondary institutions (excluding CCC).

Missing baseline covariate data These is missing baseline covariate data for some students. The analyses were done using complete case analysis, i.e., excluding all students for which at least one baseline covariate is missing. Non-dual enrollment participants are slightly more likely to have at least one missing baseline covariate measurement than dual enrollment participants. Complete case analysis in this context may yield biased causal effect estimates.

Potential solutions to this issue can include multiple imputation of the missing baseline covariate data or re-coding of the data to include a “missing” level for categorical variables and by binning continuous variables and adding a missing level (6, 7).

Type and dosage of treatment Currently, the analysis treats all dual enrollment participation as equivalent in terms of the effect on outcomes. For example, student who took one career and technical education course during their junior and senior years and a student that took 10 general studies courses during their junior and senior years would both be considered as dual enrollment participants in the causal analysis. Yet, it is reasonable to believe that these forms of dual enrollment participation would not have equivalent effects. This is because the course subject and the number of credits taken can have differing effects on outcomes (8). By treating all types and dosages of dual enrollment as participation, the interpretation of the causal estimates is affected. The estimates should be interpreted as the average effect of dual enrollment on dual enrollment participants based on the distribution of dual enrollment taken. This means that the estimates may not be predictive of the effect of dual enrollment if there are shifts in dual enrollment course-taking patterns and dosages.

High school GPA and dual enrollment

While dual enrollment eligibility requirements in Nebraska are not standardized across high school or postsecondary institutions, a 3.0 GPA is a common requirement for dual enrollment in the United States (9). However, there are generally some requirements or recommended academic eligibility thresholds for dual enrollment participation. This can be inferred empirically by examining the proportion of dual enrollment students that have at least a 3.0 high school GPA (between ninth and tenth grade) and by examining the official guidelines about dual enrollment participation in Nebraska.

NSWERS data indicates that over 80 percent of dual enrollment participants at public Nebraska postsecondaries taking general studies course work have over a 3.0 GPA statewide. Across institutions, this percentage varies between 68 percent and 94 percent. More dual enrollment participants at four-year institutions tend to have at least a 3.0 GPA than at two-year institutions. A smaller majority of dual enrollment participants taking career and technical education (CTE) coursework have over a 3.0 GPA. The proportion of CTE dual enrollment participants is at least 60 percent across all institutions which offer CTE coursework.

A non-representative sample of both high school and postsecondary guidance on dual enrollment eligibility in Nebraska indicates that academic requirements for dual enrollment are common (10–14).

Table 20: 2016 - 2022 cohort: Proportion of dual enrollment students with at least a 3.0 GPA

	General Ed.	CTE
University of Nebraska	90.9% (12,087/13,540)	-
Metro Community College	68.7% (8,109/12,117)	60.4% (4,393/ 7,401)
Southeast Community College	83.5% (7,262/ 8,906)	68.6% (4,316/ 6,492)
Peru State College	88.6% (4,141/ 4,724)	-
Northeast Community College	82.9% (4,645/ 5,703)	73.9% (1,588/ 2,194)
Mid-Plains Community College	85.2% (3,253/ 3,889)	76.4% (989/ 1,323)
Western Nebraska Community College	79.2% (2,051/ 2,633)	61.3% (965/ 1,643)
Chadron State College	94.1% (666/ 725)	-
Wayne State College	89.1% (271/ 307)	-
All	81.0% (36,559/46,115)	65.9% (12,223/19,018)

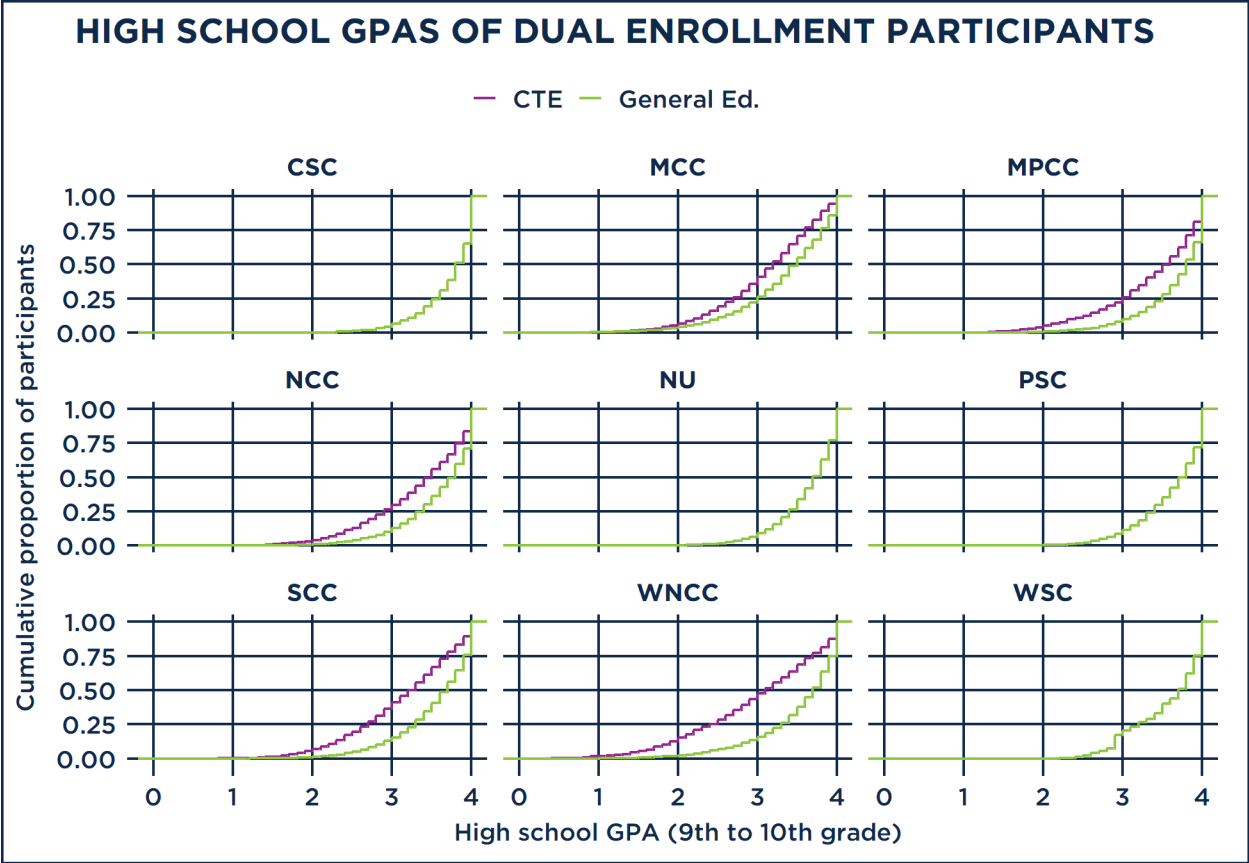


Figure 1: Cumulative proportion of dual enrollment students by their 9th and 10th grade GPA, dual enrollment course type, and institution within the 2016 through 2022 cohorts.

Time-to-event analysis of award attainment

The Postsecondary Graduation section includes an analysis of how dual enrollment credit earning is associated with the time to award attainment. Students were classified into three college credit earning categories: 0 credits, 1-12 credits, and 12 or more credits. The 0 credit category consists of student that never participated in dual enrollment or participants that did not pass their dual enrollment course. The time of award attainment was operationalized as the difference in time between high school graduation and the date of the earliest earned award. If an award was never earned by a student within the 6 year observation window the time of award was treated as right-censored at the 6 year mark.

The time-to-event analysis involved using the Kaplan-Meier estimator to calculate the survival function using the function `survfit` in the `survival` R package (15). The credit earning bin (0 credits, 1-12 credit, 12+ credits) was treated as a stratum variable. This non-parametric estimator was used because it can be used in situations with right-censoring which is a feature of award data, since it is possible that a student may eventually earn an award outside of the six year observation window used in this report for postsecondary graduation.

Note that this analysis is not causal and may be confounded by differences between students in different dual enrollment credit earning categories. This is because the treatment in this analysis had more than two categories, as such, methods used for a binary treatment variable are not adequate for this situation. Note that methods exist for causal analysis of multi-category treatments in observational settings. In future reports, these methods may be used to obtain causal estimates of how the time to award attainment is impacted by dual enrollment credit earning.

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Supplementary Data

These tables contain estimates of observed difference (unadjusted) and causal effect (adjusted) for dual enrollment participation on all outcomes for all cohorts. These tables provide all three estimates described in the methods: risk difference (RD, also presented in main text), odds ratio (OR), and the risk ratio (RR).

Table 21: Estimated effect of DE participation on on-time high school graduation among participants

Effect	Cohort year	Unadj.	Adj.
RD	2016	0.12 (0.10, 0.14)	0.02 (0.02, 0.03)
RD	2017	0.12 (0.11, 0.14)	0.02 (0.02, 0.03)
RD	2018	0.12 (0.10, 0.14)	0.02 (0.02, 0.03)
RD	2019	0.14 (0.12, 0.16)	0.03 (0.03, 0.04)
RD	2020	0.17 (0.14, 0.20)	0.04 (0.03, 0.04)
RD	2021	0.17 (0.14, 0.21)	0.04 (0.03, 0.04)
RD	2022	0.19 (0.16, 0.22)	0.04 (0.04, 0.05)
RR	2016	1.14 (1.11, 1.17)	1.02 (1.02, 1.03)
RR	2017	1.15 (1.12, 1.17)	1.03 (1.02, 1.03)
RR	2018	1.14 (1.12, 1.17)	1.02 (1.02, 1.03)
RR	2019	1.17 (1.13, 1.20)	1.03 (1.03, 1.04)
RR	2020	1.20 (1.16, 1.25)	1.04 (1.03, 1.05)
RR	2021	1.21 (1.17, 1.26)	1.04 (1.03, 1.04)
RR	2022	1.23 (1.19, 1.28)	1.04 (1.04, 1.05)
OR	2016	11.12 (8.58, 14.41)	2.74 (2.15, 3.49)
OR	2017	10.18 (8.07, 12.85)	2.60 (2.09, 3.24)
OR	2018	9.23 (7.43, 11.48)	2.21 (1.82, 2.69)
OR	2019	11.10 (8.84, 13.93)	3.01 (2.44, 3.73)
OR	2020	17.21 (13.23, 22.39)	4.19 (3.35, 5.24)
OR	2021	17.17 (13.41, 21.99)	3.88 (3.14, 4.80)
OR	2022	20.87 (16.01, 27.20)	4.73 (3.76, 5.96)

Effect	Cohort year	Unadj.	Adj.
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Table 22: Estimated effect of DE participation on college going among participants

Effect	Cohort year	Unadj.	Adj.
RD	2016	0.21 (0.19, 0.22)	0.06 (0.05, 0.08)
RD	2017	0.20 (0.18, 0.21)	0.06 (0.05, 0.07)
RD	2018	0.21 (0.19, 0.22)	0.06 (0.05, 0.08)
RD	2019	0.22 (0.20, 0.23)	0.09 (0.07, 0.10)
RD	2020	0.25 (0.24, 0.27)	0.10 (0.08, 0.11)
RD	2021	0.27 (0.25, 0.29)	0.10 (0.08, 0.11)
RR	2016	1.32 (1.29, 1.35)	1.08 (1.06, 1.10)
RR	2017	1.30 (1.27, 1.32)	1.08 (1.06, 1.09)
RR	2018	1.32 (1.29, 1.34)	1.08 (1.06, 1.10)
RR	2019	1.33 (1.31, 1.36)	1.11 (1.09, 1.13)
RR	2020	1.41 (1.38, 1.44)	1.13 (1.11, 1.15)
RR	2021	1.45 (1.41, 1.49)	1.12 (1.10, 1.14)
OR	2016	3.34 (3.04, 3.67)	1.58 (1.42, 1.76)
OR	2017	3.09 (2.82, 3.37)	1.53 (1.38, 1.69)
OR	2018	3.27 (3.00, 3.56)	1.58 (1.43, 1.75)
OR	2019	3.56 (3.27, 3.87)	1.85 (1.68, 2.03)
OR	2020	4.11 (3.78, 4.48)	1.95 (1.77, 2.14)
OR	2021	4.59 (4.18, 5.04)	1.99 (1.81, 2.20)

Table 23: Nebraska two-year: Estimated effect of DE participation on persistence among participants

effect	Cohort year	Unadj.	Adj.
RD	2016	0.18 (0.15, 0.21)	0.10 (0.06, 0.14)
RD	2017	0.17 (0.14, 0.20)	0.09 (0.05, 0.13)
RD	2018	0.16 (0.13, 0.19)	0.08 (0.04, 0.12)
RD	2019	0.15 (0.12, 0.18)	0.07 (0.03, 0.10)
RD	2020	0.18 (0.14, 0.21)	0.09 (0.05, 0.13)
RD	2021	0.17 (0.14, 0.20)	0.09 (0.04, 0.13)
RR	2016	1.36 (1.29, 1.44)	1.17 (1.10, 1.25)
RR	2017	1.33 (1.26, 1.41)	1.14 (1.07, 1.22)
RR	2018	1.31 (1.25, 1.38)	1.13 (1.06, 1.20)
RR	2019	1.29 (1.22, 1.37)	1.11 (1.04, 1.18)
RR	2020	1.35 (1.28, 1.43)	1.15 (1.07, 1.24)
RR	2021	1.33 (1.26, 1.41)	1.14 (1.07, 1.22)
OR	2016	2.16 (1.89, 2.48)	1.55 (1.31, 1.83)
OR	2017	2.04 (1.78, 2.33)	1.45 (1.22, 1.72)
OR	2018	1.96 (1.73, 2.24)	1.40 (1.18, 1.65)
OR	2019	1.87 (1.63, 2.15)	1.32 (1.12, 1.56)
OR	2020	2.11 (1.83, 2.43)	1.48 (1.23, 1.78)
OR	2021	2.06 (1.79, 2.38)	1.45 (1.22, 1.73)

Table 24: Nebraska four-year: Estimated effect of DE participation on persistence among participants

effect	Cohort year	Unadj.	Adj.
RD	2016	0.10 (0.08, 0.12)	0.05 (0.02, 0.07)
RD	2017	0.09 (0.07, 0.11)	0.03 (0.01, 0.05)
RD	2018	0.08 (0.06, 0.10)	0.02 (0.00, 0.04)
RD	2019	0.08 (0.06, 0.09)	0.01 (0.00, 0.03)
RD	2020	0.10 (0.08, 0.12)	0.04 (0.02, 0.06)
RD	2021	0.10 (0.08, 0.12)	0.04 (0.02, 0.06)
RR	2016	1.12 (1.10, 1.15)	1.05 (1.03, 1.08)
RR	2017	1.11 (1.09, 1.14)	1.03 (1.01, 1.06)
RR	2018	1.10 (1.08, 1.12)	1.03 (1.00, 1.05)
RR	2019	1.09 (1.07, 1.11)	1.02 (1.00, 1.04)
RR	2020	1.13 (1.10, 1.16)	1.05 (1.02, 1.07)
RR	2021	1.13 (1.10, 1.16)	1.05 (1.02, 1.08)
OR	2016	2.28 (1.95, 2.67)	1.57 (1.29, 1.90)
OR	2017	2.14 (1.83, 2.51)	1.34 (1.10, 1.64)
OR	2018	2.02 (1.73, 2.36)	1.26 (1.04, 1.52)
OR	2019	1.98 (1.69, 2.33)	1.18 (0.98, 1.42)
OR	2020	2.20 (1.89, 2.54)	1.45 (1.22, 1.72)
OR	2021	2.33 (2.01, 2.70)	1.51 (1.25, 1.83)

Table 25: OOS four-year: Estimated effect of DE participation on persistence among participants

effect	Cohort year	Unadj.	Adj.
RD	2016	0.09 (0.05, 0.12)	0.02 (0.00, 0.05)
RD	2017	0.05 (0.02, 0.08)	0.01 (-0.02, 0.03)
RD	2018	0.04 (0.01, 0.07)	0.03 (-0.01, 0.07)
RD	2019	0.03 (0.00, 0.07)	0.01 (-0.02, 0.05)
RD	2020	0.03 (0.00, 0.07)	-0.01 (-0.05, 0.03)
RD	2021	0.03 (0.00, 0.06)	0.00 (-0.04, 0.03)
RR	2016	1.10 (1.06, 1.14)	1.03 (1.00, 1.05)
RR	2017	1.06 (1.02, 1.09)	1.01 (0.98, 1.04)
RR	2018	1.05 (1.01, 1.09)	1.03 (0.99, 1.08)
RR	2019	1.04 (1.00, 1.08)	1.02 (0.98, 1.05)
RR	2020	1.04 (1.00, 1.08)	0.99 (0.95, 1.03)
RR	2021	1.03 (0.99, 1.07)	1.00 (0.96, 1.04)
OR	2016	3.23 (2.02, 5.16)	1.57 (0.96, 2.57)
OR	2017	1.81 (1.24, 2.63)	1.08 (0.70, 1.65)
OR	2018	1.57 (1.12, 2.21)	1.37 (0.91, 2.07)
OR	2019	1.43 (0.99, 2.05)	1.17 (0.79, 1.73)
OR	2020	1.39 (1.00, 1.93)	0.88 (0.58, 1.35)
OR	2021	1.31 (0.95, 1.80)	0.98 (0.66, 1.46)

Table 26: NDE cohort: Estimated effect of DE participation on persistence among participants

effect	Cohort year	Unadj.	Adj.
RD	2016	0.37 (0.35, 0.38)	0.15 (0.13, 0.17)
RD	2017	0.35 (0.33, 0.37)	0.13 (0.11, 0.15)
RR	2016	2.51 (2.37, 2.66)	1.33 (1.28, 1.39)
RR	2017	2.43 (2.30, 2.56)	1.27 (1.23, 1.32)
OR	2016	4.86 (4.46, 5.30)	1.85 (1.71, 2.01)
OR	2017	4.52 (4.18, 4.89)	1.67 (1.55, 1.80)

Table 27: Nebraska two-year: Estimated effect of DE participation on graduation among participants

effect	Cohort year	Unadj.	Adj.
RD	2016	0.25 (0.21, 0.29)	0.15 (0.11, 0.20)
RD	2017	0.24 (0.21, 0.28)	0.11 (0.07, 0.15)
RR	2016	1.88 (1.71, 2.05)	1.41 (1.26, 1.57)
RR	2017	1.87 (1.71, 2.03)	1.26 (1.15, 1.38)
OR	2016	2.88 (2.47, 3.37)	1.87 (1.54, 2.27)
OR	2017	2.82 (2.44, 3.25)	1.55 (1.32, 1.83)

Table 28: Nebraska four-year: Estimated effect of DE participation on graduation among participants

effect	Cohort year	Unadj.	Adj.
RD	2016	0.17 (0.15, 0.20)	0.06 (0.04, 0.09)
RD	2017	0.18 (0.15, 0.21)	0.07 (0.04, 0.09)
RR	2016	1.30 (1.25, 1.35)	1.09 (1.05, 1.13)
RR	2017	1.31 (1.25, 1.37)	1.10 (1.05, 1.14)
OR	2016	2.23 (1.99, 2.51)	1.37 (1.20, 1.56)
OR	2017	2.28 (2.02, 2.58)	1.40 (1.22, 1.60)

Table 29: OOS four-year: Estimated effect of DE participation on graduation among participants

effect	Cohort year	Unadj.	Adj.
RD	2016	0.12 (0.06, 0.17)	0.01 (-0.04, 0.06)
RD	2017	0.05 (0.00, 0.10)	-0.03 (-0.08, 0.02)
RR	2016	1.17 (1.09, 1.26)	1.01 (0.95, 1.07)
RR	2017	1.07 (1.00, 1.14)	0.96 (0.91, 1.03)
OR	2016	1.84 (1.40, 2.42)	1.04 (0.77, 1.40)
OR	2017	1.31 (1.02, 1.68)	0.85 (0.63, 1.14)



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